

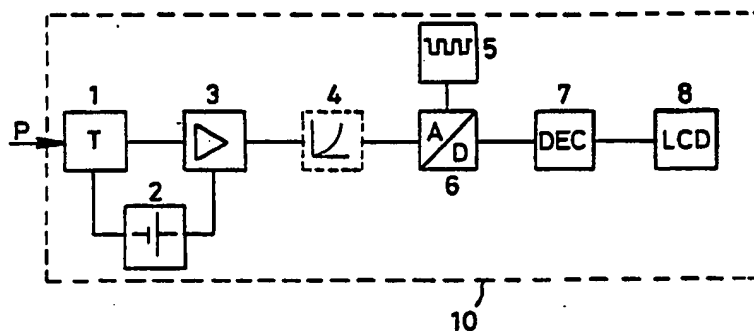


INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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9009190.1 24 April 1990 (24.04.90) GB(71) Applicant (for all designated States except US): **ITW LIMITED [GB/GB]; St Marks House, St Marks Road, Windsor, Berkshire SL4 3BD (GB).**

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(75) Inventor/Applicant (for US only) : **SMITH, Rowland, Charles [GB/GB]; 20 Venator Place, Wimborne, Dorset BH21 1DQ (GB).**(74) Agent: **GODDARD, George, William, John; Hughes Clark & Co., 114-118 Southampton Road, London WC1B 5AA (GB).**(81) Designated States: **AT (European patent), BE (European patent), CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, KR, LU (European patent), NL (European patent), SE (European patent), US.****Published***With international search report.**Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.*(54) Title: **MINIATURE ELECTRONIC PRESSURE GAUGE**

(57) Abstract

A miniature electronic pressure gauge is described comprising a case (10) having an aperture leading to a transducer (1) connected to an amplifier (3), the transducer (1) and amplifier (3) being powered from a power source (2) in the form of a storage battery such as a Nicad battery. A pressure signal from the amplifier (3) is fed to a linearisation circuit (4) and to an analogue/digital converter (6) clocked with pulses from clock generator (5). The output of converter (6) is fed to a decoder/driver (7) for a seven segment L.C.D. (8). In a preferred construction the pressure gauge is releasably retained in a fluid-tight engagement in a bore in the wall of a pressure chamber of a paint spray gun.

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MINIATURE ELECTRONIC PRESSURE GAUGE

This invention relates to a miniature preferably digital electronic pressure gauge.

More particularly, the invention provides pressure transducer means in a sealed enclosure having its own power source, said enclosure being retained by releasable retaining means in fluid-tight engagement in a cavity in a wall of a pressure chamber, said cavity leading to the interior of the chamber.

10 The transducer as aforesaid may be fitted to a paint spray gun, and is removably fastened by means of a screw or bayonet fitting.

Various embodiments of the invention will now be described, by way of example only, with reference to the 15 accompanying drawings, in which:

Fig. 1 is a block diagram of a miniature digital electronic pressure gauge according to the invention providing for display of the measured pressure;

Fig. 2 is a block diagram of a second form of the 20 pressure gauge providing an output signal for further processing;

Figs. 3 to 5 are respectively a fragmentary perspective view of a spray gun having a pressure gauge according to the invention fitted thereto, a sectional 25 view of the gun showing the path taken therethrough by compressed air, and a detail section showing how the gauge is retained in the gun body; and

Fig. 6 is a side view of a second form of a spray gun.

30 In Fig. 1 a miniature digital electronic pressure gauge comprises a case 10 having an aperture leading to a transducer 1 connected to an amplifier 3, the transducer 1 and amplifier 3 being powered from a power source 2 in the form of a small storage battery. A pressure signal 35 from the amplifier 3 is fed (if necessary) to a linearisation circuit 4 and thence to an analogue/digital converter 6 clocked with pulses from clock generator 5.

The output of converter 6 is fed to decoder/driver 7 for a seven-segment display 8 of the liquid crystal type. The casing 10 is made of high grade stainless steel and is sealed against the ingress of liquid or gaseous fluids 5 under pressure. By this means the unit is intrinsically safe for use in hazardous areas. The power source 2 is a nicad battery such as is now common in calculators and watches. On the exhaustion of the cell 2, the unit may be discarded to be replaced with a new sealed unit. The 10 unit is desirably accurate to within 2% and can read from 0 to 400 PSI; it is important that it should always read 0 under nil applied pressure.

The unit of Fig. 2 is similar to that of Fig. 1 except that an output signal 15 is taken from the 15 linearisation circuit 4.

In Figs. 3 to 5 the unit of Fig. 1 is shown fitted to a manually operated paint spray gun. A threaded aperture in a casing 20 of the gun accepts a retaining bush 22 in which the pressure gauge unit is fitted. The 20 bush 22 seats on an O-ring 24 in the body 20, and a bore 26 leads from a region of the air path downstream of the trigger 28 and adjacent the spreader control valve 30 to the aperture in the casing 10.

In Fig. 6 there is shown a paint spraygun for 25 automatic operation having a body 31 fitted with pressure transducers 33, 35 in the fluid and air supply paths.

It will be appreciated that transducers of similar structure may be fitted to compressors, air regulators, fluid regulators, tyre pressure gauges and control 30 panels.

CLAIMS:

1. A pressure transducer means comprising a sealed enclosure for said pressure transducer means, a power source for supplying power to said transducer means, a releasable retaining means, a walled pressure chamber defining a bore in said wall wherein said sealed enclosure is retained by said releasable retaining means in fluid-tight engagement in said bore and said bore leads to the interior of said pressure chamber.
2. A pressure transducer as claimed in Claim 1, wherein said transducer releasably fits into said bore by a screw-threaded retaining means.
3. A pressure transducer as claimed in Claim 1, wherein said transducer releasably fits into said bore by a bayonet retaining means.
4. A paint spray gun having a body defining an interior space through which air under pressure can be passed, a bore defined in said body leading from said interior space, wherein said bore leads to a pressure transducer as claimed in Claim 1.

1-4

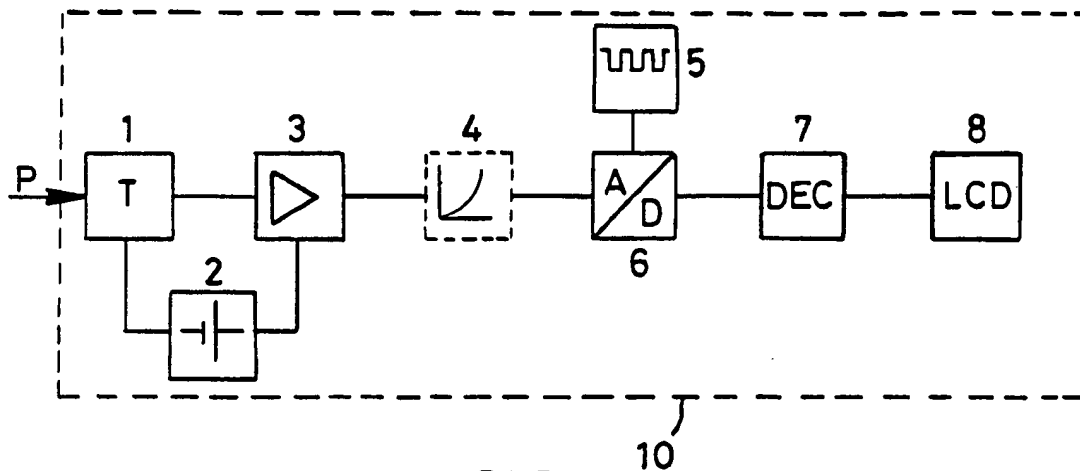


FIG.1.

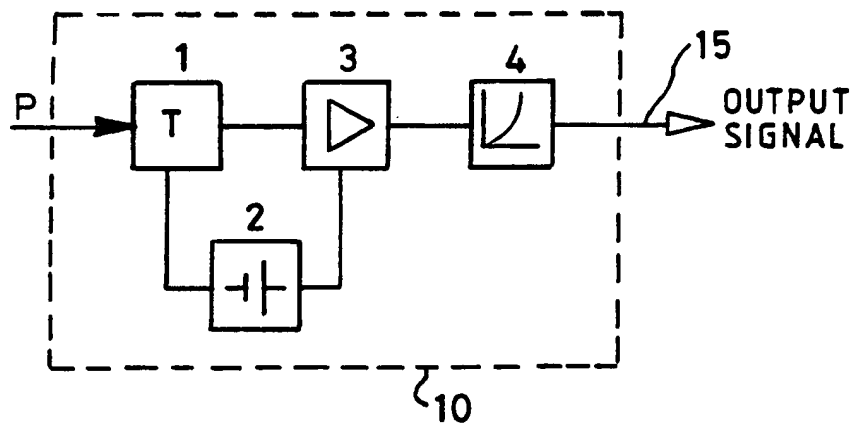
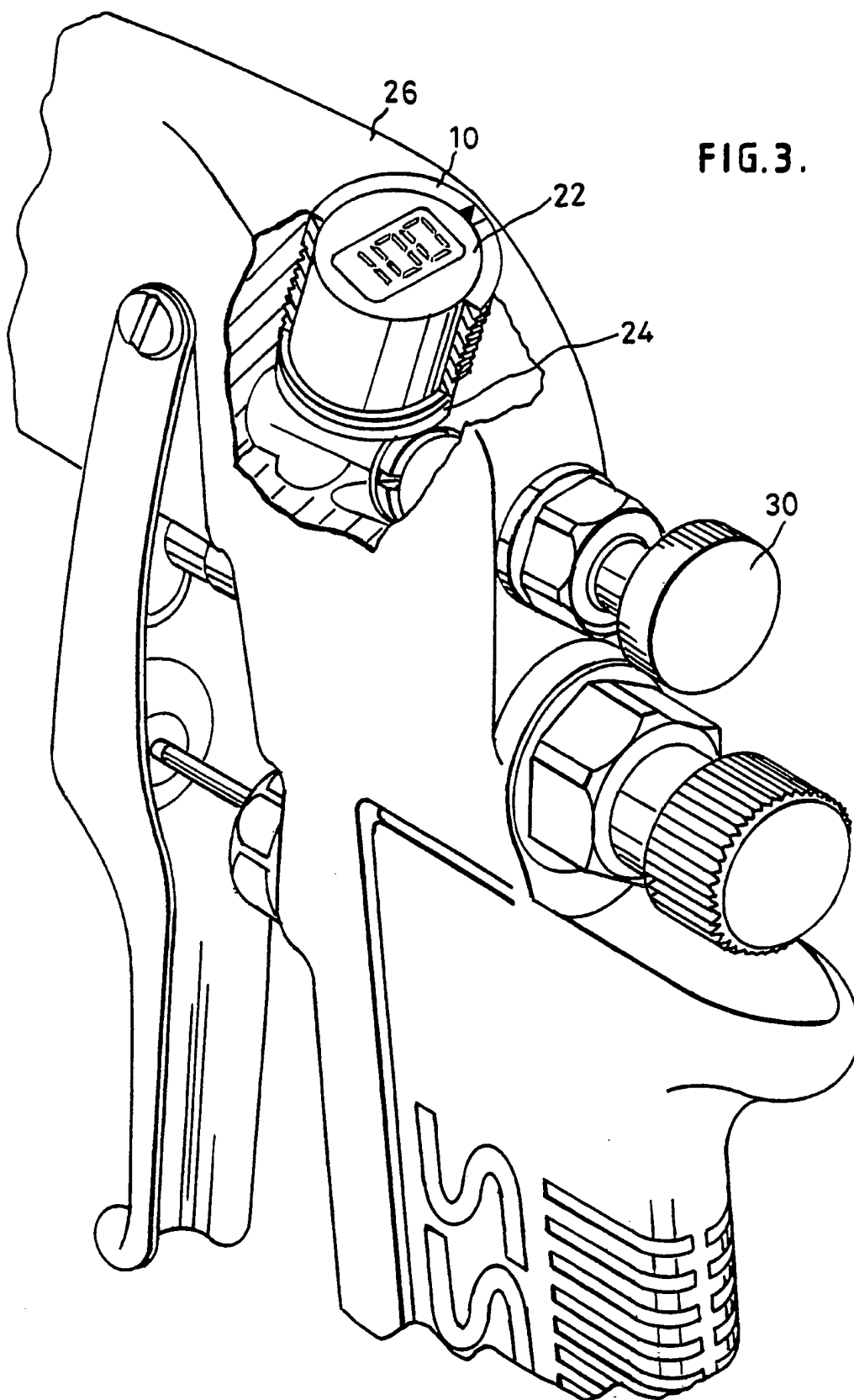
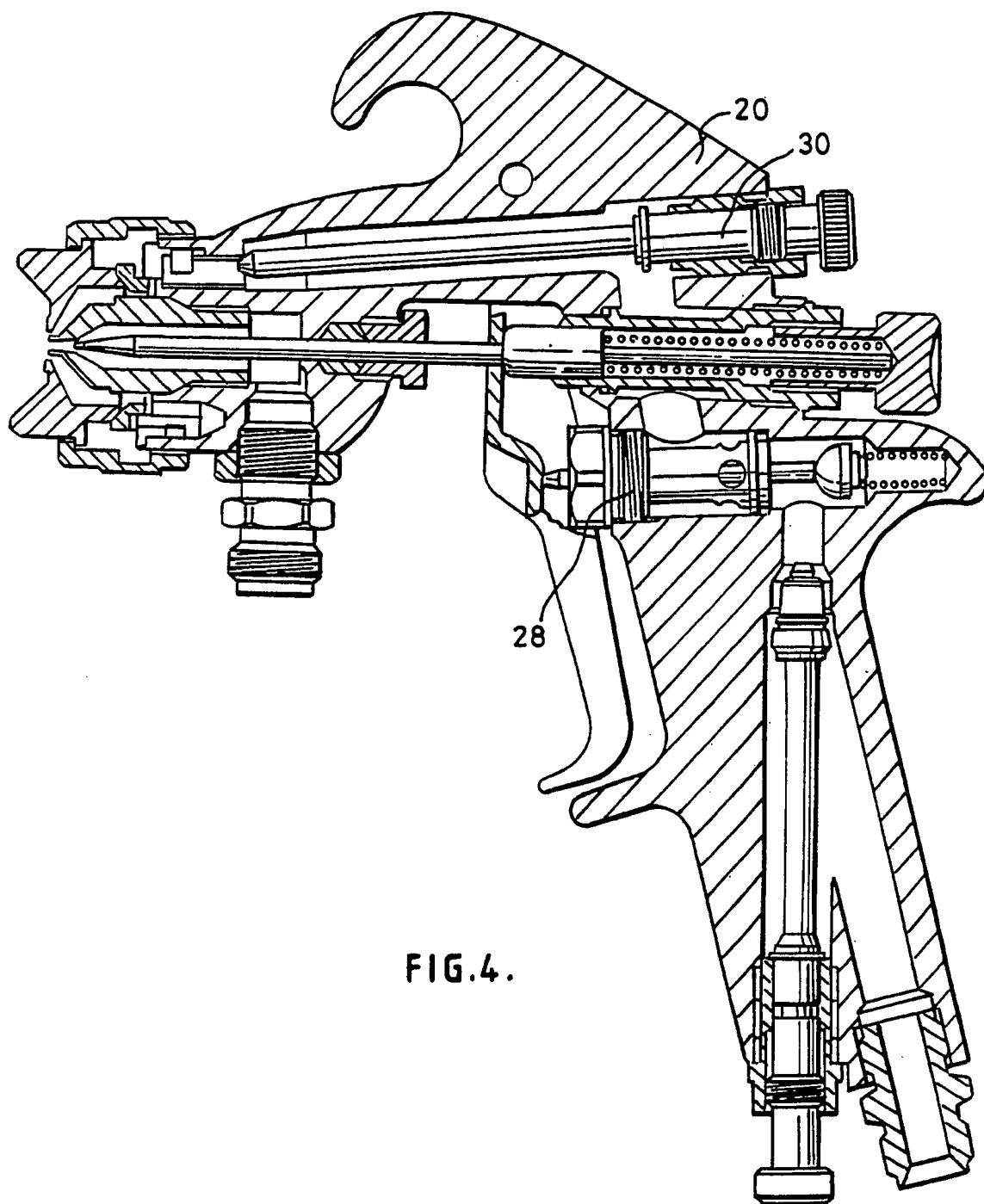


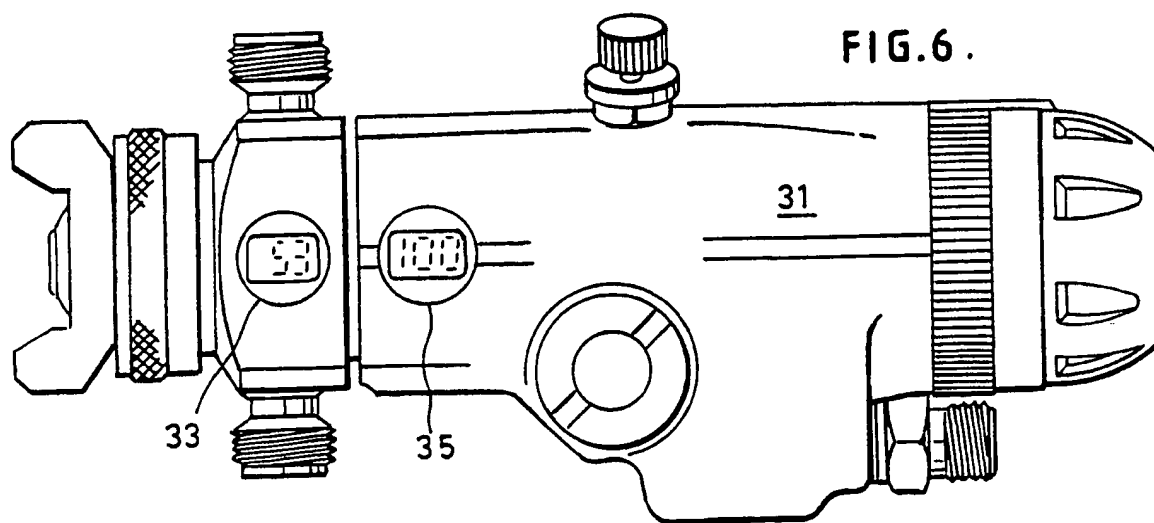
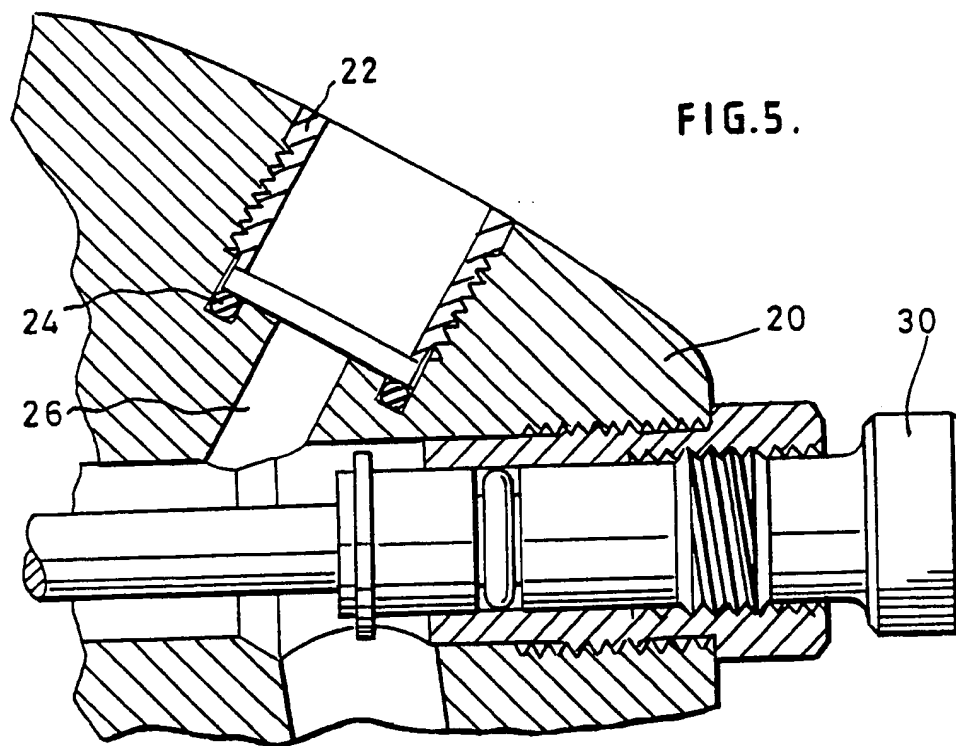
FIG.2.

2-4



3-4





INTERNATIONAL SEARCH REPORT

International Application No.

PCT/GB 9100652

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC G 01 L 19/00 B 05 B 15/00																				
II. FIELDS SEARCHED <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black; margin: 5px 0;">Minimum Documentation Searched⁷</div> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%; border-bottom: 1px solid black; padding: 5px;">Classification System</td> <td style="border-bottom: 1px solid black; padding: 5px;">Classification Symbols</td> </tr> <tr> <td style="padding: 5px;">Int.Cl.5</td> <td style="padding: 5px;">G 01 L B 05 B B 05 B</td> </tr> </table> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black; margin: 5px 0;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched⁸</div>			Classification System	Classification Symbols	Int.Cl.5	G 01 L B 05 B B 05 B														
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III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹ <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%; padding: 5px;">Category¹⁰</th> <th style="width: 70%; padding: 5px;">Citation of Document,¹¹ with indication, where appropriate, of the relevant passages¹²</th> <th style="width: 20%; padding: 5px;">Relevant to Claim No.¹³</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">X</td> <td style="padding: 5px;">F&M Feinwerktechnik & Messtechnik, vol. 97, no. 12, (München, DE), H.C. Rapp-Hückler et al.: "Feinwerktechnik und Dünnschichttechnologie im elektronischen Manometer", pages 563-566, see page 564, left-hand column; figures 1-2 ---</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1,2</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="text-align: center; vertical-align: top; padding: 5px;">---</td> <td style="text-align: center; vertical-align: top; padding: 5px;">4</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">X</td> <td style="padding: 5px;">GB-A-2 189 887 (M.S. SLANEY) 4 November 1987, see abstract; figures</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1,2</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="text-align: center; vertical-align: top; padding: 5px;">---</td> <td style="text-align: center; vertical-align: top; padding: 5px;">4</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="padding: 5px;">US-A-4 108 008 (T.W. JOWETT et al.) 22 August 1978, see figure 2 --- -/-</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1,2</td> </tr> </tbody> </table>			Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	X	F&M Feinwerktechnik & Messtechnik, vol. 97, no. 12, (München, DE), H.C. Rapp-Hückler et al.: "Feinwerktechnik und Dünnschichttechnologie im elektronischen Manometer", pages 563-566, see page 564, left-hand column; figures 1-2 ---	1,2	Y	---	4	X	GB-A-2 189 887 (M.S. SLANEY) 4 November 1987, see abstract; figures	1,2	Y	---	4	Y	US-A-4 108 008 (T.W. JOWETT et al.) 22 August 1978, see figure 2 --- -/-	1,2
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<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>¹⁰ Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> </div> </div>																				
IV. CERTIFICATION <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;">Date of the Actual Completion of the International Search</td> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;">Date of Mailing of this International Search Report</td> </tr> <tr> <td style="text-align: center; padding: 5px;">17-07-1991</td> <td style="text-align: center; padding: 5px;">17. 09. 91</td> </tr> <tr> <td style="border-bottom: 1px solid black; padding: 5px;">International Searching Authority</td> <td style="border-bottom: 1px solid black; padding: 5px;">Signature of Authorized Officer</td> </tr> <tr> <td style="text-align: center; padding: 5px;">EUROPEAN PATENT OFFICE</td> <td style="text-align: center; padding: 5px;"> Danielle van der Haas </td> </tr> </table>			Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	17-07-1991	17. 09. 91	International Searching Authority	Signature of Authorized Officer	EUROPEAN PATENT OFFICE	 Danielle van der Haas										
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III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
Y	Patent Abstracts of Japan, vol. 10, no. 225 (P-484)[2281], 6 August 1986, & JP-A-61 61 029 (AISIN SEIKI CO. LTD) 28 March 1986, see abstract; figure ---	1
Y	EP-A-0 084 445 (NORDSON CORP.) 27 July 1983, see abstract; page 5, lines 28-33; figures 1,2 ---	4
A	Und-Oder-Nor + Steuerungstechnik, vol. 22, no. 12, December 1989, (Mainz, DE), P. Mihm: "Anpassung neuer piezoresistiver Druckmessumformer an verschiedene Prozeßanschlüsse", page 72, see whole document -----	2,3

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB-A- 2189887	04-11-87	None	
US-A- 4108008	22-08-78	None	
EP-A- 0084445	27-07-83	US-A- 4430886	14-02-84
		AU-B- 560281	02-04-87
		AU-A- 1026983	21-07-83
		CA-A- 1200299	04-02-86
		JP-A- 58146820	01-09-83